The Free Vibration Analysis and Low-velocity Impact Response of a Rectangular Sandwich Plate with a Honeycomb Core and Nanocomposite Face Sheets in Contact with Quiescent Fluid

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Abstract:

This article is dedicated to the free vibration analysis and low-velocity impact response of a rectangular sandwich plate in contact with quiescent fluid. The core of the plate is a honeycomb structure which can be either a hexagonal (non-auxetic) or a re-entrant (auxetic) one. The core is covered with two nanocomposite face sheets fabricated from a polymeric matrix reinforced with either graphene nanoplatelets (GNPs), graphene oxide powders (GOPs), or carbon nanotubes (CNTs). The mechanical properties of the nanocomposite face sheets are calculated via the rule of mixture and the Halpin-Tsai model. The plate is modeled based on Murakami's zig-zag theory and the quiescent fluid is modeled based on the potential theory. The governing equations are derived utilizing Hamilton's principle and are analytically solved via the Navier method. It is shown that an increase in the density of the fluid results in lower natural frequencies and lower amplitude of dynamic response created by the low-velocity impact. However, it is concluded that the contact force is not influenced by the density of the fluid.